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ROLE PHYSIOLOGY AND ITS IMPACT ON SWIMMING PERFORMANCE – A REVIEW OF LITERATURE

[1]Jadhav P.U. and [2]Dagar R.S.

[1]Sant Gadge Baba Hindi Mahavidyalay, Bhusawal (M.S) India
[2]Rashtrasant TukadojiMaharaj Nagpur University, Nagpur (M.S) India

Abstract: The act of swimming takes place in a medium that presents different gravitational and resistive forces, respiratory conditions and thermal stress to the performer compared to air. Moreover, the energy cost of propulsion in swimming is high, but a considerable reduction occurs at a given velocity as result of regular swim training. For example, in the event of medley the energy cost is lowest for front crawl, followed by backstroke, butterfly and breast-stroke. In addition to this the dynamics of physiology and muscle movements while swimming makes the research pertaining to same very critical. Hence, a systematic review of the body of literature pertaining to this aspect (physiology and swimming performance) available through reputed journals has been carried out. The review process is conducted by considering the general principles of deductive reasoning and is presented in chronological order. The study shows that though certain specific investigations have been carried out, most of them are with the elite swimmers of developed countries, which are hardly directly applicable in the Indian context. Thus, there appears to be an urgent need to conduct focused research in the field of physiology of swimmers and its role in their performance.

Keywords:Swimmers, Physiology, Energy, Muscle movements, Performance

Introduction:

Swimming is a great activity that provides a thorough workout to all parts of the body, and is suitable to people of all ages and abilities. Swimming does not place the stress on bones and joints like running and other sports do. Regular swimming builds endurance, muscle strength and cardio-vascular fitness. It encourages steady, deep breathing and is excellent for improving lung capacity. Those with breathing difficulties such as asthma often find swimming a highly effective treatment. It is ideally one of the best ways to exercise all the muscles of the body without any additional pressure. Swimming usually is multidimensional - while some indulge in swimming for recreation, there are others who take it up as a competitive sport, yet others for whom swimming is a means of earning their daily livelihood. In India, swimming is widely popular in all the three aspects - as a general activity, sporting event as well as occupational reasons.

Competitive swimmers tend to specialize in either sprint or distance events to suit their innate and conditioned physiological characteristics. As a result, coaches design specific training programs to direct the swimmers' optimal performance in their chosen event. Despite the specialization of the swimmer, these training programs often include a wide range of intensities in order to develop physiological aspects regarded as deficient. However, the possible impact of this accepted practice on the swimmers' stroke mechanics has not been considered adequately. For example, it is unknown whether sprinters training at a distance pace, or vice versa, will adapt their technique to the extent that may negatively affect their performance. Bearing in mind the principle of specificity with regard to training, this is an important consideration and needs further investigation and hence, a systematic study has been carried out to review the literature pertaining role of physiology and swimmer's performance.

Methodology:

In this study a focused literature review was carried out to identify the previous research efforts and directions related to our focal area. The objective was to identify the research gaps and highlight research motivations for future studies. An attempt has been made to present the discussions in a chronological order, so that the review also indicates the underlying pattern of

evolution of thoughts and ideas in that domain. Similarly, to the extent possible, care has been taken to reproduce the terminology used by the authors, to preserve the originality of their views. The literature review addressed various issues encompassing the physiological parameters and its impact on the performance of swimmers. These domains have been reviewed in a systematic manner. Sincere efforts have been made by the research scholar to locate the related literature and the discussion in presented hereunder.

Discussion:

In terms of the metabolic requirements, it is generally acknowledged that the three systems which supply energy for skeletal muscle contraction (i.e. ATP-Phosphocreatine, anaerobic glycolysis and the aerobic system) are all simultaneously activated during swimming exercise. The intensity and duration of exercise determines the relative contribution of each system to the resupply of the fuel adenosine triphosphate (ATP) (Sharp 1992). In the shortest swimming event, the 50 m sprint, the relative contributions for each of the systems are (approximately): ATP-PC 65%; anaerobic glycolysis 30%; and aerobic 5%. For a 200 m event the contributions are: ATP-PC 10%, anaerobic glycolysis 50%; and aerobic 40%, while for a 1500 m the breakdown is: ATP-PC 2-5%, anaerobic glycolysis 20%; and aerobic 75-80%. Open water or long-distance events rely almost exclusively on the aerobic energy system. The underlying energy systems and the characteristics of swimmers and competitive events form the basis of the training program (Roberts, 1991). In simple terms, the two main physiological characteristics of highly trained swimmers are power and endurance. Endurance fitness is related to the aerobic energy system and, in the context of the tests outlined in this chapter, is assessed indirectly with a graded incremental swimming test.

Smith et al., (2002) provide a critical commentary of the physiological and psychological tools used in the evaluation of swimmers. According to him the first-level evaluation should be the competitive performance itself, since it is at this juncture that all elements interplay and provide the 'highest form' of assessment. Physiological parameters that are often examined alongside swimming speed and technical aspects include oxygen uptake, heart rate, blood lactate concentration, blood lactate accumulation and clearance rates. Authors stated that there is convincing evidence that athletes can be distinguished on the basis of their psychological skills and physiological efficacies. Kubukeli et al., (2002) observed that in previously untrained individuals, endurance training improves peak oxygen uptake (VO_2 peak), increases capillary density of working muscle, raises blood volume and decreases heart rate during exercise at the same absolute intensity. In contrast, sprint training has a greater effect on muscle glyco(geno)lytic capacity than on muscle mitochondrial content.

Moreover, Dawson et al., (2002) in his study concluded that 4 weeks of Creatinine supplementation did not significantly improve single sprint performance in competitive swimmers, but it did enhance swim bench test performance. In addition to this Mendes et al., (2004) also suggested that creatine supplementation cannot be considered to be an ergogenic supplement ensuring improved performance and muscle mass gain in swimmers. In the study by Palayo et al., (2007) it is mentioned that in order to assess aerobic potential and establish exercise-intensity domains for swimmers, it is important that exercise-intensity domains be accurately defined and their physiological underpinnings well understood to optimize and evaluate training programs. Moreover, warm-up before competition might enhance performance by affecting various physiological parameters (Zochowski et al., 2007).

Carrasco et al., (2007) reported that swimming competition (short-term maximal type of effort) induces a psychological and physiological stress, which stimulates the secretion of endorphins, which are secreted to counter the negativeeffectsof competitive stress, although more research is needed to accurate the relationship between END and anxiety levels during exercise. Psycharakiset

al., (2008) examined the relationships between selected kinematic and physiological parameters and stated that it they influence performance of swimmers (during incremental exercise) competing at the international level. Lätt et al., (2009)analyzed the development of physiological, biomechanical and anthropometrical parameters in young female swimmers and assessed the effect of these parameters on swimming performance during biological maturation. Authors reported that biomechanical factors best characterized the 400-metre swimming performance in young female swimmers, followed by bioenergetical and physical factors.

Conclusions:

Swimmingis a popular activity with proven cardiovascular benefits yet lacks the features thought necessary to stimulate positive adaptive changes, especially in bone. Often the competitive swimmers are predisposed to musculoskeletal injuries of the upper limb, knee, and spine, which affect their swimming activity and also the physiological readiness of the body (for competitive swimming). Though there are few studies of swimming, but complex responses to water-based exercise suggest its potential for differential effects has not been studied in the Indian context thoroughly. Although several studies have demonstrated that motor intervention can enhance physiological processes and improve swimmer's performance, little is known about itseffecton stretching, flexibility and body structure. Hence, in view of the study results, it is important to conduct a more focused research on the needs of swimmers vis-à-vis training for improving physiology.

References:

1) **Carrasco L, Villaverde C, Oltras C.M.** Endorphin responses to stress induced by competitive swimming event. J Sports Med Phys Fitness. 2007; 47(2):239-45.

2) **Dawson B, Vladich T, Blanksby B.A.** Effects of 4 weeks of creatine supplementation in junior swimmers on freestyle sprint and swim bench performance. J Strength Cond Res. 2002; 16(4):485-90

3) **Kubukeli Z.N., Noakes T.D., Dennis S.C.,**Training techniques to improve endurance exercise performances., Sports Med. 2002;32(8):489-509.

4) **Lätt E, Jürimäe J, Haljaste K, Cicchella A, Purge P, Jürimäe T.,**Longitudinal development of physical and performance parameters during biological maturation of young male swimmers., Percept Mot Skills. 2009. 108(1):297-307.

5) **Mendes R.R., Pires I, Oliveira A, Tirapegui J,**Effects of creatine supplementation on the performance and body composition of competitive swimmers. J NutrBiochem. 2004; 15(8):473-8.

6) **Palayo P, Alberty M, Sidney M, Potdevin F, Dekerle J.,** Aerobic potential, stroke parameters, and coordination in swimming front-crawl performance., Int J Sports Physiol Perform. 2007; 2(4):347-59.

7) **PsycharakisS.G., CookeC.B.,Paradisis G.P., O'Hara J, Phillips G.,** Analysis of selected kinematic and physiological performance determinants during incremental testing in elite swimmers., J Strength Cond Res. 2008; 22(3):951-7.

8) **Roberts A.D. (1991)** Physiological capacity for sports performance. In: Pyke FS (ed.) Better Coaching: Advanced Coach's Manual. Canberra: Australian Coaching Council, pp 43-54.

9) **Sharp R.L. (1992)** Exercise physiology: proper conditioning. In: Leonard J (ed.) Science of Coaching Swimming. Champaign, Illinois: Leisure Press, pp 71-98.

10) **Smith D.J., Norris S.R., Hogg J.M.,** Performance evaluation of swimmers: scientific tools, Sports Med. 2002;32(9):539-54.[1]

11) **Zochowski T, Johnson E, Sleivert G.G.,** Effects of varying post-warm-up recovery time on 200-m time-trial swim performance.,Int J Sports Physiol Perform. 2007; 2(2):201-11.

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